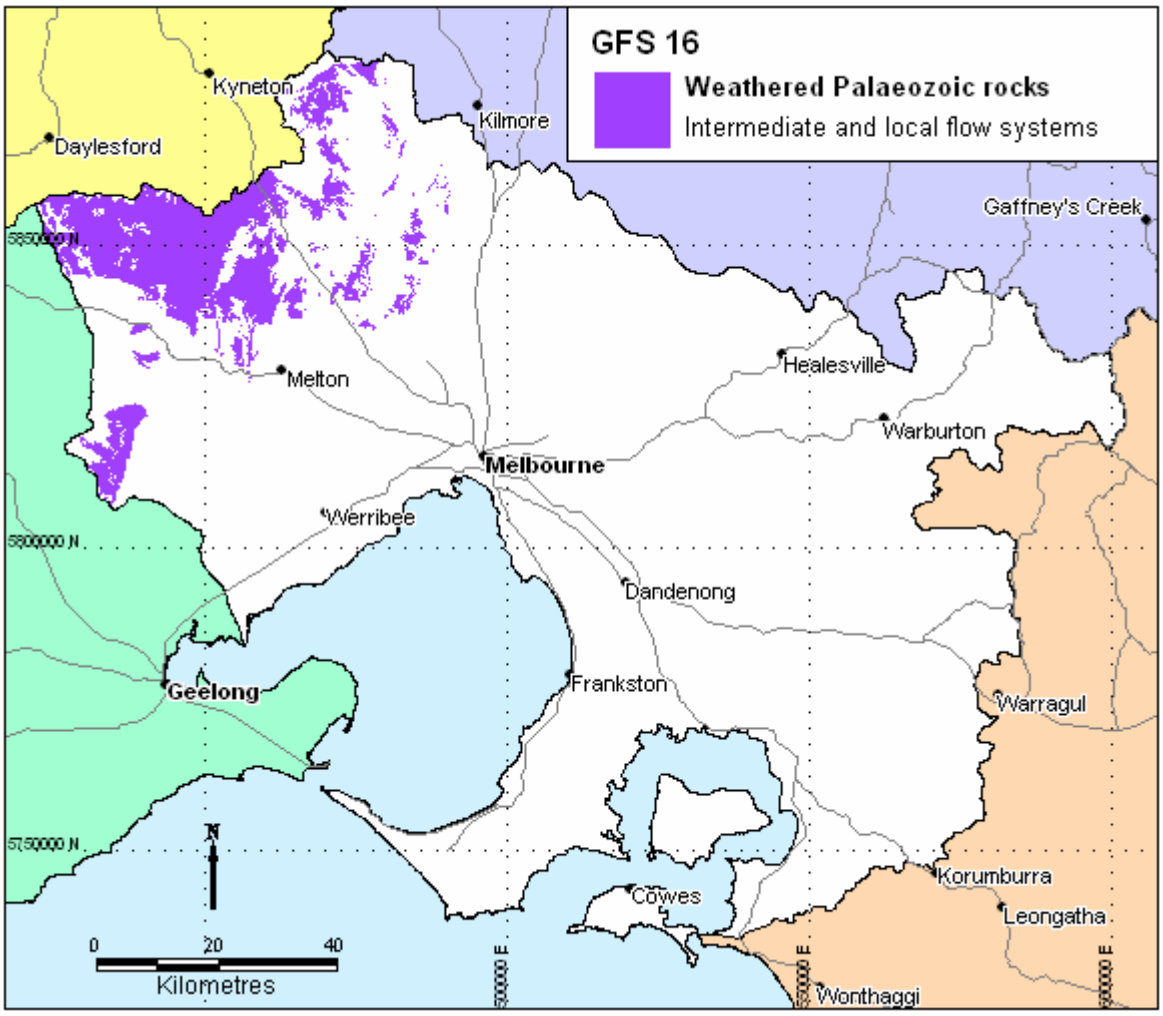
Intermediate and local flow systems in the weathered Palaeozoic rocks

Region: North west PPWP CMA region

Type areas: Gisborne, Toolern Vale, Blackwood

Brief description: Ordovician age sedimentary rocks make up the basement of the Western portion of the PPWP CMA region. These sandstones and mudstones have been folded and faulted, injected with quartz veins and intruded by granites. Extensive erosion has removed several kilometres thickness of material and the exposed rocks are deeply weathered. They are covered by an uneven thickness of weathered rock and soil.

Groundwater slowly moves through the fractured rocks and regolith in both local and intermediate flow systems.



Problem statement: Small areas of salinity are associated with this GFS in the Durdidwarrah – Steiglitz area, Cobaw – Newham area, and north of Riddell's Creek. The salinity generally occurs along drainage lines and probably results from hydrologic changes due to land clearing.

Landscape attributes

Geology: Silurian-Devonian Fluvial conglomerates, sandstones, and siltstones (SDk) and Ordovician marine sediments: sandstones, siltstones, shales, chert (Ol, Ola, Olb, Oll, Olm, Oly, Olr, Ou, Oub, includes Castlemaine Supergroup and Romsey Group).

Topography: Undulating hills, broad valleys, can be locally steep.

Land Systems:

Central Victorian Uplands	Western Victorian Volcanic Plains
2.1 West Victorian Dissected Uplands - Midlands	*7.1 Undulating Plains – Western District*

Regolith: Variable deeply weathered profile (soil, saprolite, saprock to fresh rock).

Annual rainfall: 500 mm to 1200 mm

Dominant mid-1800s vegetation type: Forest with some minor Woodland

Current dominant land uses: Grazing, forestry, urban and rural residential, conservation areas.

Mapping method: Outcrop geology

Hydrogeology

Aquifer type (porosity): Fractured rock and saprolite (secondary porosity).

Aquifer type (conditions): Unconfined and semi-confined.

Hydraulic Conductivity (lateral permeability): Highly variable. The saprolite varies from approximately 10^{-5} m/d to 10^{-1} m/d and the rock varies from 10^{-5} m/d to 1 m/d.

Aquifer Transmissivity: Highly variable in the low to moderate range. Estimated to be generally less than 50 m^2/d.

Aquifer Storativity: Variable. Estimated to be less than 0.03 for saprolite and 0.02 to 0.05 for the fractured rock.

Hydraulic gradient: Estimated to be moderate in intermediate systems and locally steep in local systems.

Flow length: Generally <25 km for intermediate systems and <5 km for local systems.

Catchment size: Small (~<500 Ha) for local systems and moderate (>100 km^2) for intermediate systems.

Recharge estimate: Approximately 40 mm to 50 mm annually.

Temporal distribution of recharge: Seasonal (winter and spring), with more recharge in wetter years.

Spatial distribution of recharge: Catchment wide but varies with the depth of regolith, slope and wet areas in the landscape.

Aquifer uses: Minor use, mainly for stock and domestic purposes.

Salinity

Groundwater salinity (TDS): Generally in the range of 1000 mg/L to 8000 mg/L.

Salt store: Moderate to high.

Salinity occurrence: Creek lines, valley floor, break-of-slope, hillside seeps.

Soil Salinity Rating: S2 to S3.

Salt export: Both baseflow to streams and wash-off from surface.

Salt impacts: Both on-site and off-site.

Risk

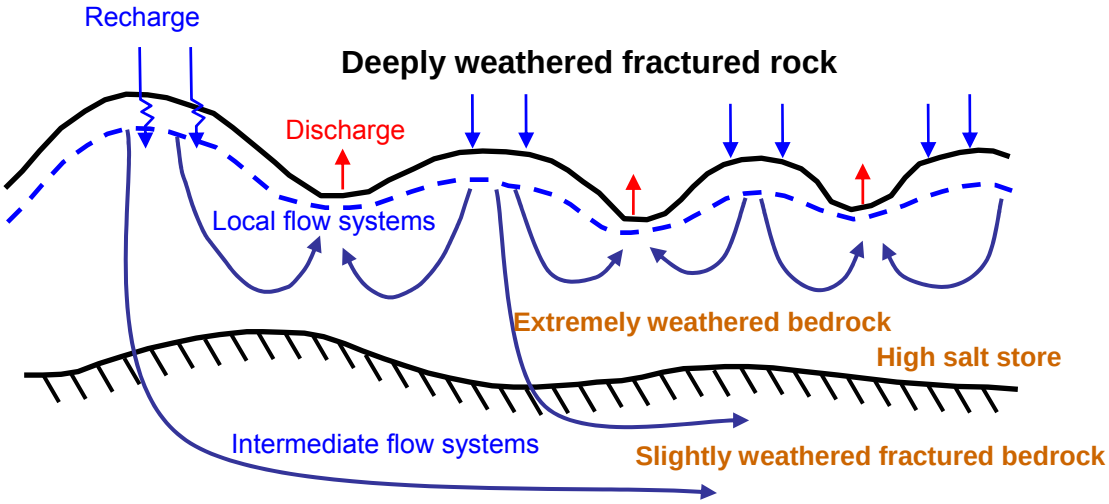
Soil salinity hazard: High.

Water salinity hazard: High.

Assets at risk: Water quality of the Upper Maribyrnong River system, agricultural land, engineering and urban infrastructure, conservation areas.

Responsiveness to land management: Largely unknown, but thought to be moderate for intermediate flow systems and high for local flow systems.

Conceptual model



Salinity (S1) developed in a tributary to Deep Creek, at Lancefield. The salinity occurs in a thin veneer of creek alluvium overlying the deeply weathered Palaeozoic sedimentary rocks.

Management Options

Salinity management strategies are required to address the development of salinity in the higher rainfall regime to the east of the Macedon Ranges, and the more moderate rainfall region of the Steiglitz-Durdidwarrah area at the southern end of the GFS.

The establishment of productive perennial pastures with opportunistic tree planting in cleared, lower rainfall terrain at Steiglitz-Durdidwarrah could be significant in reducing the extent of salinity discharge in localised flow systems.

Effective recharge control is limited adjacent to the Macedon Ranges by the higher rainfall, which approaches 700 mm/yr. In agricultural systems maintaining pasture health with perennial habit will at least assist in resisting runoff and associated waterlogging.

Dryland agriculture options for managing salinity in local and intermediate flows in **weathered Palaeozoic rocks**.

Salinity focus: Durdidwarrah-Steiglitz, Cobaw-Newham, Riddell's Creek

Options	Treatments	Comments
Biological Management of recharge	Perennial pastures	Low to moderate impact– depending upon climatic zone. Productive perennial pastures will at least assist with runoff and waterlogging control
	Crop management	Low impact– cropping is generally absent in these landscapes
	Trees/woody vegetation	Low to moderate impact– where able to be incorporated into overall land use system to reduce gross recharge, runoff and waterlogging
Engineering intervention	Surface drainage	Low impact– disposal issues
	Groundwater pumping	Low impact– low hydraulic conductivities make pumping expensive. Disposal issues
Productive uses of saline land and water	Salt tolerant pastures	High impact– to stabilise and aesthetically improve salt affected areas
	Halophytic vegetation	Low impact– climate and environs not likely to be conducive
	Saline aquaculture	Low impact– discharge sites only minor in extent
	Salt harvesting	Low impact– groundwater is not sufficiently saline
	Others	See OPUS database (NDSP)

Management implications given projected land use

Pressure for rural residential development on this GFS at Riddell's Creek should be tempered with suitable planning guidelines. Responsible measures for reducing excessive recharge (and runoff and waterlogging) in both agricultural and rural-residential zones should be encouraged. Infrastructure development should be avoided where the salinity hazard is presented in the hazard.